DIVISION OF THE HUMANITIES AND SOCIAL SCIENCES

CALIFORNIA INSTITUTE OF TECHNOLOGY

PASADENA, CALIFORNIA 91125

RESPONSES TO DISASTER:
PLANNING FOR A GREAT EARTHQUAKE IN CALIFORNIA

Linda Cohen, Roger Noll, and Barry Weingast

SOCIAL SCIENCE WORKING PAPER 131

Rev. April 1977

RESPONSES TO DISASTER: PLANNING FOR A GREAT EARTHQUAKE IN CALIFORNIA*

Linda Cohen, Roger Noll and Barry Weingast

Since the San Jacinto earthquake of 1899, earthquakes causing five or more deaths have struck California eight times -- about once every ten years.[1] Three of these quakes were near enough

[1] John H. Wiggins and Donald F. Moran, Earthquake Safety in the City of Long Beach Based on the Concept of "Balanced Risk," J. H. Wiggins Co., 1971, p. C-9.

to major population centers to cause extensive damage and loss of life: San Francisco in 1906, Long Beach in 1933, and San Fernando in 1971.

Each major earthquake in California -- particularly the 1933 and 1971 events -- catalyzed significant changes in public policies to defend against and respond to a repetition of the past disaster. Defensive policies include seismic resistivity standards for buildings and dams, and since 1906 -- and especially

* The research reported in this paper was financed in part by the Jet Propulsion Laboratory out of funds provided by the National Aeronautics and Space Administration and in part by the National Science Foundation program of Research Applied to National Needs, grant number APR75-16566. The authors are grateful for the information about existing disaster plans supplied by officials in the California Office of Emergency Services, the County of Los Angeles, Orange County, and the cities of Los Angeles and Long Beach, and for the comments on an earlier draft by Jack Hirshleiffer and Arnold Meltsner.

since 1933 -- several California communities, most notably the City of Long Beach, have developed the most rigorous, complex building codes in the country. Responsive policies cover planning and training oriented to providing effective, speedy relief services to a disaster-stricken community. Since 1971, when coordination of relief efforts proved to be a major problem, local government in California, prodded by the state Office of Emergency Services, has engaged in more extensive relief planning than was the case in the past.

The principal purpose of this paper is to establish an analytical framework for assisting disaster relief planners in assessing the effectiveness of existing plans and devising realistic allocations of responsibilities among relief organizations. The paper builds on an earlier tradition of disaster studies: while major earthquakes are relatively rare events, major disasters are not, and the patterns of physical and psychological damage to disaster victims have been well documented.—/ The environment in which planning and relief

—/The classic work in this area is by C. Fritz, e.g. "Disasters Compared in Six American Communities," Human Organization 16, Summer 1957; and "Disaster," in R. Martin and R. A. Nisbet, eds., Contemporary Social Problems, New York: Harcourt, Brace, & World, Inc., 1961. See also the references in section 1 of this paper.

organizations must operate, including the nature and extent of damage an earthquake might cause and the likely behavioral response of both members of relief organizations and the client population, is fairly predictable. The first section of this paper is concerned with the immediate post-earthquake environment, and in particular with the behavior of the disaster victims.

The second section focuses on the likely behavior of relief organizations immediately following an earthquake. It contains an economic analysis of the incentives facing planners before an earthquake strikes and an organization-theoretic analysis of the hierarchical structure and operating experiences that agencies will carry over from their normal activities. The third section examines the existing plans for responding to an earthquake in Southern California. Its main purpose is to determine whether the assumptions that are implicit in the plan about the extent and nature of damage and the behavior of individuals and organizations during relief operations are consistent with the findings in the first two sections. In several respects, the plans are found to ignore certain criticial features of the likely post-earthquake environment and response capability of relief organizations. Some suggestions are offered for improving plans to take account of these factors.

1. THE EARTHQUAKE PLANNING ENVIRONMENT

Fritz has concluded that four disaster characteristics influence the behavioral responses of individuals after the event:

1. The speed of the event.
2. The nature of the event - e.g. its frequency, controllability and predictability.
3. The physical scope, destructiveness, and intensity of of the event.
4. The duration of the threat.[1]

---

[1] C. Fritz, 1957. See also Dynes, Quarantelli, and Kreps, A Perspective on Disaster Planning, Defense Civil Preparedness.

In the absence of accurate earthquake predictions, a major earthquake fits into this categorization as the type of disaster which causes maximal psychological damage to victims.

The physical damage from recent major earthquakes is described in numerous books and essays. The striking physical characteristics of an earthquake include no or negligible forewarning, widespread damage but prior uncertainty as to the exact nature of the damage -- e.g., floods, fires, or collapsed buildings and their locations -- and loss of communications facilities.[2] Given this type of event, a "disaster profile"

---

[2] Of particular interest in evaluating Los Angeles plans are the books on Los Angeles earthquakes. See, e.g., Olson,

"Individual and Organizational Dimensions of the San Fernando Earthquake," in M. Murphy (Scientific Coordinator), San Fernando, California, Earthquake of February 9, 1971, U.S. Department of Commerce, 1973, Vol. 11; Paul Jennings, ed., Engineering Features of the San Fernando Earthquake February 9, 1971, California Institute of Technology, 1971; Hypothetical earthquakes are discussed in A Study of Earthquake Losses in the Los Angeles, California Area, National Oceanographic and Atmospheric Administration U.S. Department of Commerce, 1973. A complete bibliography is beyond the scope of this paper: for a more general cataloguing of the literature, see G. White and J. Haas, Assessment of Research on Natural Hazards, MIT Press, 1975.

---

of the victims can be pieced together from the numerous psychological and sociological studies.[3] Almost universal

---

[3] See, in particular, J. Hirshleiffer, Disaster and Recovery: a Historical Survey, Memorandum, RM-3079-PR, The RAND Corporation: Santa Monica, California, April, 1963; T. Scudder, "Possible Applications of Relocation Theory to Earthquake Response," Caltech (mimeo), 1975; Chenault, Engler, and Nordlie, Social and Behavioral Factors in the Implementation of Local Survival and Recovery Activities, Human Sciences Research, Inc.: McLean, Virginia, August, 1967; P. Smith and L. Breger, "Psychological Reactions to Environmental Disasters with Special Reference to

Earthquakes," Caltech (mimeo) 1975; Fritz, 1957; Dynes, et al. 1972.

---

agreement exists about the behavior of the disaster victims. They will not panic, and disorientation is extremely rare. Rather, they tend to pursue constructive activities and immediately begin relief activities within the community. A strong sense of community identification is generated. This is accompanied by a strong tie among the "in-group" versus "outsiders," and distrust of strangers. Severe damage leads to reordered values among the populace, who will in general rank the safety and welfare of the family first, and then concern for the immediate community. There is disagreement about the capacity of the victims for undertaking innovative behavior. Scudder questions their ability to do so while they are under severe stress. What innovation does occurr appears to come from within the community and to be directed at community problems. In general, an outsider will not be able to reorganize activities immediately following the disaster.

The implications of this profile for planning are fairly obvious. The planner is uncertain about the extent and location of damages, and may lack communication facilities. Relying on local communities to coordinate efforts according to a previously unused plan is unrealistic. Corrdination between the various disaster-hit communities is unlikely. How the

Los Angeles planning agencies now address these problems is discussed in the last section of the paper. The historical record abounds with examples of delayed or frustrated relief, inhibited coordination efforts and inter-community communication that can be traced to this disaster profile.

An example from the San Fernando earthquake was the inability of relief organizations to coordinate their operations at the collapsed Veteran's Administration Hospital. "Most apparent was the fact that the local, State, and Federal agencies that were involved conducted their emergency activities independently of each other at a time when team effort or coordination would have been mutually helpful. This was evidenced by the almost total lack of communication among the agencies." —/ The

---

—/ Report of the Los Angeles County Earthquake Commission, San Fernando Earthquake, February 9, 1971, November 1971, p. 21.

Los Angeles Fire Department discovered the heavy damage at the hospital by a helicopter reconnaissance flight at 7:25 a.m. and immediately dispatched units to the hospital. The District Engineer of the U.S. Army Corps of Engineers learned of the damage from a commercial television broadcast at 7:45 a.m., but could not reach the scene of the disaster until shortly after 9:00 a.m. The County fire department became aware of the event at 9:05 a.m., and the Sheriff's Department, the last of the

relevant agencies to learn of it, heard at 10:30. Eventually all of these groups appeared, but the initial communications foul-up hindered further coordinated activities.[1]

[1] Report of the Los Angeles County Earthquake Commission, San Fernando Earthquake, February 9, 1971, November 1971, p. 21.

A particularly vivid example of the "in-group" - "outsider" syndrome is the case of three relief efforts after the 1976 Guatemala earthquake. [1] Nadel contrasts the relief efforts of three agencies that were involved in housing reconstruction. Despite widespread damage, housing was not a particularly vital problem in many of the Guatemalan villages. By the time the relief agencies arrived, most of the villagers had made satisfactory temporary arrangements for housing. Nevertheless, two agencies - the Guatemalan army and CARE - had preconceived relief ideas which they tried to press on villagers. The result was hostility and non-cooperation from the villagers and, in some cases, totally wasted efforts. The army, for instance, "put up a refugee camp which became an instant ghost town...There weren't many in San Martin who considered themselves refugees."[2] The third

[1] G. Nadel, "Guatemala After the Terremoto," in Atlantic, Vol 238, No. 1, July 1976, pp. 14-21.

[2] Nadel, p. 19

agency - OXFAM - contented itself with educating villagers on methods of building seismically resistent huts. While the results were not immediate, Nadel notes that the effects of the program were certainly longer-lasting, and addressed real problems. The approach by the other agencies led to total lack of communication and impact as the communities closed themselves off from outsiders.

2. A PERSPECTIVE ON MUNICIPAL SERVICE ORGANIZATIONS

Major earthquakes produce radical changes in the environmental conditions of relief agencies. They must respond to unusual conditions, and coordinate efforts with unfamiliar agencies, while suffering from the earthquake themselves. The organizations providing relief are themselves disrupted, particularly in the crucial few hours immediately following an earthquake.[1] Hirshleiffer notes that following a disaster agencies may act rapidly under the right conditions. "If these groups are well-trained and prepared, they may perform prodigies; if not, they may not function at all."[2]

[1] R. Dynes, Organized Behavior in Disasters, Disaster Research Center Monomgraph Series #3, Ohio State University: Columbus, Ohio, 1969.

[2] Hirshleiffer, p. 7

Organizations differ in their ability to cope with the post-earthquake environment. As Hirshleiffer and other authors note, usually the agencies with prior experience in emergency services or that normally coordinate efforts respond most effectively immediately following a disaster.—/ The

—/See also Dacy and Kunreuther, The Economics of Natural Disasters; Implications for Federal Policy, The Free Press: New York, N.Y., 1969.

usual organization-theoretic rationale for this phenomena is that the organizations' characteristics -- in particular its standard operating procedures -- are expensive to adopt and take time to develop.—/ In other words, procedures are fixed in

—/See, generally, J. March and H. Simon, Organizations, John Wiley and Sons, Inc.: New York, N.Y., 1958, Ch. 7.

the short run.

This argument is buttressed by the standard economic formulation of production functions. A municipal service organization has two general categories of tasks for which it must prepare. The first is the provision of normal services and the second is disaster relief. Though the two types of tasks are usually related, they are not identical. Since resources

available to the organization are limited, a trade-off exists between greater capacity for normal operations and greater capacity for disaster response.

One manifestation of this trade-off is the decision-making structure chosen by the agency. The agency selects a structure somewhere on the continuum from totally centralized to completely decentralized decision making.—/ The advantages

—/ See J. Marschak and R. Radner, An Economic Theory of Teams, Yale University Press: New Haven, Connecticut, 1972.

of a centralized organization stem from economies of scale in collecting and processing information. The sources of these scale economies are numerous, but among the more important are the following. First, a policy decision or a set of operating instructions is a kind of public good. Focusing responsibility at a single source allows the simultaneous solution of problems common to several subunits in the agency and hence economizes on total decision-making effort. Second, centralization allows specialization of decision-making tasks to a greater degree than does decentralization, for the traditional resasons expressed first by Adam Smith. Third, a centralized authority is able to deal more effectively with the allocation of reasons among subunits, in part because its actions do not require the attainment of voluntary consensus among the units and in part because a

centralized system requires fewer communications links to assure that allocational decisions are based upon complete information.

The advantages of decentralization stem from its avoidance of the more extensive communications system that a hierarchical organization requires. A communication system has direct costs associated with constructing and operating it, and an indirect cost in that it causes delays in decision-making while information is transmitted to decision-makers and instructions are transmitted to functional units. An organization that relies upon an extensive information system is vulnerable to errors and distortions in the data available to it, particularly in the short run when information cannot as easily be checked for accuracy. In particular, a decentralized agency may perform vastly better in any emergency, and especially after an earthquake when communication and transportation systems are disrupted. The centralized agency will perform better if speed is not essential, communication is good, and resources must be allocated among a number of subunits.

Other structural characteristics, such as the degree of job routinization, can be identified which similarly effect the output of the agency. The point is that efficient delivery of one type of service may preclude another. If an agency concentrates on normal services it may be inefficient at providing emergency services. Planning is supposed to counteract

this tendency: theoretically, a good plan is a substitute for actual experience. Unfortunately, an agency has an incentive to specialize in the provision of normal services, which usually means that the agency does not plan seriously for the delivery of disaster services.

An agency must choose its resource allocation in the face of the trade-off between normal and emergency services. Because earthquakes are such rare events, agencies are likely to concentrate on producing normal services without much regard to the effects of their choices on earthquake response. Despite the importance of the services performed by an agency during a disaster, the principle purpose of the organization is associated with its normal operations. The political process which gave birth to the agency tends to have a short time horizon. Elected officials, seeking, reelection, will focus on normal services which are more likely to provide immediate payoffs. If the political time horizon is relatively short, the best bet is obviously that no earthquake will occur. Consequently, unless officials are particularly concerned with the possibilities of an earthquake, investment in preparation for emergency operations may be viewed as unimportant since it probably will not yield any tangible benefits for which they can claim credit.

Individual employees in relief agencies face a similar set of incentives. First, since political leaders determine agency budgets, they will transmit their preferences for normal

operations to agencies in the budgetary process. Second, agency personnel have separate reasons to focus on normal operations. If the expected length of employment with the organization is only a few years (even a dozen or so), employees may consider any time invested in familiarizing themselves with contingency plans or preparing in other ways for emergency related services as wasted since the likelihood is small that a major earthquake will occur while they occupy their current positions.

The behavior of existing agencies is generally consistent with the preceding analysis. For example, plans for post-earthquake evacuation operations in Los Angeles were developed before the 1971 earthquake, but a captain in the police force who was instrumental in the evacuation of the area below the Van Norman Dam revealed that he had not been informed of any plans for evacuation, emergency centers for receiving evacuees, institutionalized methods of agency coordination, or allocation of local resources.[1]

[1] Interview with a police department official, July 28, 1975.

The preceding analysis leads to a paradox. Planning is essential, since an organization cannot be expected to change form immediately and effectively respond to new demands after an earthquake. On the other hand, planning requires resources, which are invested at the expense of normal operations. Consequently,

agencies are not likely to plan for disasters in the face of this trade-off, and political officials are unlikely to provide funds that are earmarked for that purpose.

Since the 1971 San Fernando earthquake, planning has received more serious consideration throughout California. Certainly the incentives of legislators, at least those from areas affected by the earthquake, were changed by the earthquake. The change has led to increased planning for disasters at all levels of government. The next section the effectiveness and practicality of these plans are considered.

3. CALIFORNIA DISASTER PLANS

The state of California has an extensive hierarchy of emergency plans, most of which have evolved from civil defense organizations that in the early years of the Cold War developed contingency plans to cope with the devastation of a nuclear attack. At the center of the planning activity is the California Office of Emergency Services (OES), which, among other duties, is responsible for state disaster planning, coordinating state disaster relief activities, and encouraging and assisting local governments in preparing for all types of disasters.[1] Most local plans are

[1] OES responsibilities are detailed in the State of California Emergency Plan, Office of Emergency Services, published in several parts from 1970 to 1973, especially Part I, pp. 2-3, and Part II, pp. 7, 13-14.

strongly influenced by OES, and even incorporate verbatim passages from state planning documents.

The basic organizational structure for mobilizing disaster relief is enunciated in the state plan.[1] It establishes several hierarchical levels of decision-making, at the top of which sits the Governor and OES who are assigned the tasks of allocating state supplies and resources, acquiring Federal assistance when appropriate, and coordinating relations among lower levels of the hierarchy. OES has divided the state into six regions, which in turn are divided into county-wide areas.[2] The state OES office deals with its regional offices, the regional OES office with the county organizations, and each county organization with the individual jurisdictions -- cities, special districts and the county government -- within its area. The county organization is operated by the jurisdictions that are members of it, not by OES. The guiding principle of the state emergency response system is that multijurisdictional activities will move up the hierarchical levels of responsibilities only as far as is necessary to provide an effective response to the disaster. A local government will ask for assistance from its neighbors through the

[1] The state plan is enunciated in a series of documents published by OES. The most important for natural disasters are: State of California Emergency Plan -- Part I: Basic Emergency Plan, 1970; Part II: Peacetime Plan, 1972; Part III: Compendium of Legislation and References, 1973; California Fire and Rescue Emergency Plan, 1972.

[2] State of California Emergency Plan -- Part II, pp. 7-12.

county coordinating authority only if coping with the disaster is beyond its abilities and resources. By the same token, the county authority appeals for regional help, and the region for statewide assistance, only when it is incapable of dealing with the problem with its own resources.[1]

Requests for mutual aid can follow complicated paths through the organizational hierarchy.[2] If a local government requests mutual aid, the plan calls for the request to be made first to the adjacent jurisdictions or, if it is operating, to the county authority. The latter, when receiving the request, determines whether it is valid. Assuming that it is, the county official then passes the request either to other jurisdictions in the county or, if their resources are otherwise committed, to the regional coordinator. Either of these evaluates the request again, with the latter having the option to pass the request either to other counties in the region or to the state OES office -- for still further evaluation. At any stage along the way, the request may legally be refused if all resources at that level are committed or if the requesting authority

[1] For a detailed and important application of these principles, see California Fire and Rescue Emergency Plan, pp. 2-6.

[2] For details, see Emergency Assistance Guide to State and Federal Resources, OES, Emergency Assitance Programs Division (undated), p. 1, and California Fire and Rescue Emergency Plan, p. 24.

is deemed capable of further self-help.

Most relief resources are in the control of local governments and, as a result, mutual aid is crucial for dealing effectively with a major disaster. State, regional and county plans are devoted in large measure to defining the terms and conditions of mutual aid agreements. Since government officials are reluctant to release resources that are paid for by their constituents to another jurisdiction, the terms of mutual aid are rigorous: a government must have exhausted its own resources and still find unmet demands for its services in order to justify a call for mutual aid.—/ A consequence of this reluctance is that each agency normally

—/A key link in the organizational hierarchy, the county-wide coordinating authority, must be activated only if the disaster is related to a state of war. In peacetime emergencies, which include an earthquake, the county authority is voluntary. If the county organization is not activated, a local government is expected to ask for help from neighboring jurisdictions before appealing to the regional office of OES. (See, for example, Basic Emergency Operations Plan, Los Angeles County Operational Area, Interim Edition, 1975, p. v.) While the county authority is voluntary, assistance from other jurisdictions -- called mutual aid -- is mandatory once the Governor declares a state of emergency. Since the county organization obviously facilitates the coordination of mutual aid requests and

assessments of local resources, its voluntary nature is likely to be unimportant -- it is inconceivable that it would not be activated should a major earthquake strike.

retains control of all of its resources as long as it has unmet demands for its services. For example, the State of California Department of Public Works can assist in "non-highway engineering and construction work . . . to the extent that the ability to maintain the state highway system is not impaired."—/ This explicitly establishes highway maintenance as the highest priority use of the department's heavy equipment and trained operational personnel, which also could be useful for heavy rescue operations or clearing local streets.

—/State of California Emergency Plan, Part II, p. 19.

For similar political reasons, local governments are reluctant to relinquish their authority over public services in their jurisdictions. Consequently, mutual aid resources, including relief personnel, are controlled by the receiving government until the need for them abates. County, regional and state emergency coordinators serve as neutral referees, deciding which localities need help and which can provide it, thereby relieving some of the interjurisdictional suspicions and rivalries that naturally are associated with the uncompensated transfer of resources and authority over personnel.

In part, the highly structured, procedurally freighted emergency response system is a consequence of the allocation of responsibilities by level of government in normal operations. Local governments provide police and fire protection, repair water systems and roads, and operate public health and welfare agencies, and these services are at the center of emergency response plans. The need for a complex mechanism of coordination arises because the level of government with the resources is not the appropriate level for organizing a response to a major disaster. But the complex organization enacts a cost in delayed response.

Local Government Plans

The companions to the state emergency plan are the plans promulgated by county, city and special district governments.—/

—/In the Los Angeles area, Orange County, Los Angeles County, the City of Los Angeles and the City of Long Beach have rather detailed plans; most jurisdictions do not.

Reflecting state guidelines, these plans usually establish Emergency Operating Centers (EOC) where local government officials will congregate to direct relief operations and to coordinate activities with other governmental units. While the city plans often create what superficially appears to be an entirely new governmental organization chart for dealing with the disaster, the changes are for the most

part cosmetic. For example, the Long Beach Plan establishes a Fire and Rescue Service and a Law Enforcement and Traffic Control Service, but the former consists of the Fire Department augmented by a few employees of the Parks Department, while the latter is the Police Department augmented by a few employees from the office of the City Prosecutor.—/

—/City of Long Beach, California, Emergency Plan for Citizen Safety, City Council Resolution C-21063, December 10, 1971.

Local government plans normally contain descriptions of the kinds of problems each emergency service organization is likely to face, the lines of authority within the local government, the coordinators with whom each director of an emergency service should maintain contact, and lines of succession should key personnel be unavailable to perform their assigned duties when the disaster strikes. The plans normally do not define the responsibilities and likely activities of personnel below the level of assistants to the directors of each of the emergency services. As recommended in the state plan,—/ each agency is given the responsibility for

—/State of California Emergency Plan, Part I, pp. 9-10.

working out detailed operational plans, a task that is for the most part neglected. In short, the existing plans are guides for the top level officials of governments for making centralized decisions,

for keeping informed about the scope of the disaster, and for coordinating activities with decision-makers at equal or higher levels of the state emergency plan. They are essentially an administrative, as compared to operational, response to state and federal requirements regarding mutual aid agreements and disaster assistance programs. As such, they stand as testimonies to the lack of incentive local officials perceive to plan an effective response to a major earthquake.

Planning for Politics, Not Disasters

The existing structure of disaster plans can be viewed as the resolution of a series of political and bureaucratic conflicts among the organizations involved in emergency preparedness. OES was created to spur localities to engage in activities that they would otherwise probably largely ignore. But given little real authority or resources, OES could not shift control of emergency response from these same local units. Instead, it could only impose on localities a complex, highly stratified, hierarchical coordination system that could be activated if local governments were unable to fend for themselves. Unfortunately, this hierarchy is, from top to bottom, a prototype of an organization designed to function least effectively during a disaster of the scope of a major earthquake, as is revealed when its structural and operational aspects are measured against the analytical template provided in the preceding sections.

The analysis in Section 2 predicts that organizations with highly centralized decision-making and routinized procedures are most likely to suffer disruption when faced with an unusual environmental condition. In addition, unfamiliar procedures take time to master. Moreover, the empirical observations that individuals under extreme stress will not undertake new patterns of behavior at the request of strangers suggests that unfamiliar hierarchical structures and operating procedures will be even less quickly mastered than normal by lower-level personnel. Yet this is precisely the type of organization that the various state and local plans have created.

An obvious conclusion is that disaster response organizations should be more decentralized with fewer hierarchical levels, along the lines of fire departments and building inspection agencies. Then the initial response to a disaster would be more effective because internal disruption would be reduced. Such a recommendation is, however, surely futile. The structure of disaster relief organizations is chosen to be consistent with producing the normal service of each agency most efficiently while retaining existing patterns of authority among agencies and jurisdictions, since only this choice is consistent with the incentives facing the components of the response organization. Unless these incentives change, a planner's recommendation that agencies and local governments restructure themselves so that they are better prepared for

earthquake response -- a structure which also implies less efficient production of normal service -- is likely to be ignored, and, at least from the point of view of local officials, for good reason.

Given that organizations are not likely to be structured so as to optimize their response to the demands of a disaster, at least knowing which agencies are likely to be most crippled by a disaster can be useful in structuring the relief assignments among agencies. Specifically, an existing agency should not be assigned a relief function just because of the conceptual similarity of the relief responsibility to the normal services of the agency. Tasks should be allocated on the basis of which organization will be able to perform these tasks, given the training of its personnel and its resources, structure and operating procedure, rather than on the basis of training and resources alone.

Search and Rescue

Search and rescue plans provide an illustrative example of the problems that can result if conceptual similarity is the sole basis of task assignment. Local plans commonly assign both fire-fighting and rescue activities to fire department since both are normal departmental activities. But the rescue part of the fire department's responsibilities is, in both normal operations and the majority of emergencies, a secondary or auxiliary activity. As a result, the natural inclination of the decision makers in the

fire department will be to focus on fires and threats of fires. In a major earthquake, this could lead to a serious error in the initial response to the disaster, as in fact happened in Anchorage in 1964.—/

—/ Immediately after the Alaska earthquake an ad hoc committee of city officials decided that the police should guard heavily damaged areas against looting and the fire department should deploy itself to prevent a conflagration. But no incidents of looting were reported, and fire personnel, after putting out the few minor fires, remained in their stations on "full alert". Not until the next day did search and rescue operations begin. See Yutzy and Haas, "Disaster and Functional Priorities in Anchorage," in Committee on the Alaskan Earthquake, The Great Alaska Earthquake of 1964, Vol. 7, Human Ecology, National Academy of Sciences, 1970.

The implication is that rescue operations ought to be severed administratively from fire-fighting. Since fire department resources are needed in both activities, someone other than fire authorities should allocate resources between fire-fighting and rescue. This can be expected to be opposed vigorously by fire authorities, who will see it as a threat -- and even an attempt by others to claim the political rewards for effective response activities by fire department personnel.

Nevertheless, the evidence indicates that existing emergency organizations are not likely to do well in search and rescue operations on a massive scale. In fact, because local plans are often drawn by committees composed of representatives from normal government agencies, search and rescue responsibilities often get overlooked in emergency preparedness. For example, the emergency plan for the City of Los Angeles does not assign primary responsibility for search and rescue to any emergency service agency; the police, the public works department, the medical care unit, and the fire department all have some aspect of search and rescue as an auxiliary task.[1]

[1] Emergency Plan for the Organization and Operation of the Civil Defense and Disaster Corps, City of Los Angeles, 1972.

No one at the city's EOC will be principally concerned about organizing effective search and rescue activities.[2] The Los

[2] The state plan does recommend the creation of "special purpose units having no pre-emergency counterparts ... to perform those activities peculiar to major emergencies." (State of California Emergency Plan, Part I, p. 9.) Except for the EOC, localities rarely plan for the establishment of such organizations, particularly when to do so would strip an existing agency of one of its existing, if secondary, responsibilities.

Angeles County planning guide lists the organization of light search and rescue operations twelfth and heavy rescue fourteenth on the priority list for the fire department, the latter below debris clearance and both below all fire-related tasks, including reports to the EOC about fire-fighting activities. Search and rescue does not appear on the police priority list.[3]

[3] Emergency Operations Guide, Los Angeles County Earthquake Planning Project, Federal Disaster Assistance Administration and California Office of Emergency Services, 1975.

Planning Novel Activities

Another implication of the preceding sections is that mechanisms for conducting novel activities must be in place prior to the earthquake, whether the mechanisms are simply machinery for interagency coordination that is not practiced normally, or different methods for performing traditional tasks. Organizations are not likely to invent these mechanisms immediately after an earthquake. Regardless of the nature of the damage resulting from an earthquake, likely patterns of interaction and communication among departments are predictable -- e.g., the police and water departments must coordinate action for evacuation of areas threatened by weakened dams. The list of possible interactions is long and difficult to construct on the spot. Making certain that individuals in relief agencies know whom to contact in other

departments or jurisdictions and what their capabilities are can be extremely productive.

Existing plans implicitly recognize this requirement of good disaster preparedness by establishing the EOC, where all relevant service chiefs will be located. Many plans go further to provide directories of state, federal and local officials who may be useful but who are not scheduled to be represented at the EOC. But the plans are not rich in informing participants in EOC operations of the kinds of coordination problems they will face. The most detailed list of possible problems and actions for each service director is contained in the operations guide for Los Angeles county.[1] While this

[1] Emergency Operation Guide, Los Angeles County Earthquake Planning Project, Federal Disaster Assistance Administration and California Office of Emergency Services, July, 1975.

document provides a checklist of emergency actions each service organization should be prepared to take, it is mute on the inter-service coordination problems that might arise.

Evidence from the moderate 1971 earthquake supports the view that coordination will not be easy. Fire departments are the agencies that are most likely to exhibit "model" coordination because of their long history of mutual aid and cooperation.

The experience at the Veterans' Hospital mentioned in Section 1 points otherwise: no agency including fire departments, communicated the severity of the damage at the hospital to the other agencies, and each initiated an independent search and rescue mission.

Emergency planning agencies, being aware of the uncertainties and coordination problems following a disaster, have focused on mechanisms for increasing the flow of information to the central command centers. For example, the state emergency plan emphasizes the importance of getting good information to relevant officials, allowing them to communicate about the implications of the information and the strategic alternatives, and communicating decisions back to the field.[1] The plan

[1] State of California Emergency Plan, Part I, Attachment Direction and Control, Office of Emergency Services, 1970, p. 1.

recommends that key emergency officials be assembled in a single site as "the most effective and economical way to accomplish direction and control under emergency condition." The Los Angeles County preparedness activities carry out this general policy by focusing on adding to communications capabilities.[1] Implicit in

[1] "Chief Adminstrative Officer's Progress Report to the Los Angeles County Board of Supervisors: Implementation of Recommendations

of the Earthquake Commission and the Earthquake Task Forces, San Fernando Earthquake: February 9, 1971," Los Angeles County, 1973.

this viewpoint are the assumptions that hierarchical, centralized organizations are required for effective response to a disaster and that such an organization can maintain sufficient communication capacity to transmit complete information about the nature of the disaster and the resources available to each functional unit.

The Problem of Disrupted Communications

Most plans do not deal seriously with, or even consider, the problems that might arise if the communications system is disrupted so that the assembled officials receive little or no information. The state plan, for example, contains a description of the existing communications resources, but no discussion of possible predisaster planning in case these resources are damaged or prove inadequate.—/

—/State of California Emergency Plan: Attachment E -- Communications System, Office of Emergency Services, 1970.

Many existing planning documents explicitly assume that communications facilities will not be severely disrupted by a major earthquake. For example, the Emergency Plan of the Los Angeles Department of Building and Safety assumes that "damage in the City will not disrupt, for any period of time, normal communications and access to work headquarters."—/ Employees are provided with the

—/Policy Order No. 33, Disaster Plan for the Department of Building and Safety, March 15, 1971, p. 1.

following instructions:

(1) Regular working hours
  (a) Office: personnel on duty in offices may be assigned other duties ...
  (b) Field: personnel working in the field ... shall call their office for instructions.
(2) Off-duty hours
  (a) The General Manager, Executive Officer, Bureau Chiefs, District and Branch Office Managers shall report to their offices ...
  (b) All other employees shall not report to their offices to perform field duties unless directed to do so by their field officers.—/

—/Ibid., p. 2.

Similarly, the state utilities plan contains only one mention of field personnel: "The first duty of a utility employee is to report his location and availability to the manager or director at the emergency operating headquarters to which he is assigned."—/ Obviously the plans

—/Utilities Emergency Plan, Office of Emergency Services, 1972, p. 5.

are relying on normal operation of the transportation and telephone systems; however the 1971 earthquake, substantially more moderate than the worst case the plans are supposed to deal with effectively, led to disruption of both the normal phone service and the emergency communications system. Both were inoperative for most of the day,

primarily because of increased use rather than physical damage due to the earthquake.—/ To limit staff to perform duties only upon

—/Olson, p. 276.

directives from disaster officials means that many staff members will, in fact, do nothing for many hours after the earthquake, and means that the number of staff members who will be deployed effectively for relief services will be inversely related to the magnitude of the disaster.

Some documents do indicate that the twin planning characteristics of reliance on communications and lack of specific preparedness directives to field personnel could prove to be severe shortcomings. For example, the federally organized planning project for Los Angeles and Orange counties prepared a guide for local planning that pointed out that repair of communications facilities was likely to be too time consuming to permit decision-makers to postpone relief response until the system could be restored.—/

—/Earthquake Response Planning Guide, Los Angeles and Orange Counties Earthquake Planning Project, Federal Disaster Assistance Administration and California Office of Emergency Services, 1975, p. 6.

The guide states that effective disaster response depends upon field personnel being well prepared for disaster assignments, yet points out that most plans refer to field personnel in only vague terms and do not include planning exercises.

The reason for the rather optimistic view that plans take of the viability of the emergency communications system is related to the broad purpose of the emergency planning documents -- and to the issues discussed above with respect to the incentives faced by organizations that have relief responsibilities. State and local emergency plans are intended to cover all disasters that stretch the resources of a single jurisdiction, from major fires to nuclear attack. The plans are primarily designed to deal with two extremes: fire and war emergencies. The latter emphasis arises because the state law makes mandatory cooperative war emergency planning and relief operations by local government. The emphasis on fires reflects the incidence of this particular type of emergency: brush and forest fires that demand multi-jurisdictional responses occur several times each year in California; most of the five events per year that lead to calls for the assistance of the state Office of Emergency Services are Fires.—/ The state plan observes that the most "dire, pervasive

—/ State of California Emergency Plan, Part Two: Peacetime Emergency Plan, Office of Emergency Services, 1972, p. 1.

and critical destructive force" with which the peacetime must cope is a major earthquake.—/ Yet the presumption within this

—/OES damage data bear this out. The 1971 San Fernando Earthquake, moderate though it was, killed 64 people and caused

an estimated $553 million in damages. The worst fire season in California history, in 1970, caused an estimated $223 million in damages, with no report on deaths. See State of California Emergency Plan, Part II, Appendix. Planning Factors -- Peacetime Emergencies, pp. 1-4.

---

and other plans that communications services will not be inadequate and that an effective response system can be hierarchically structured reflects an implicit focusing of planning activities on the less severe disasters that lead to the most frequent demands for the services of emergency organizations.

Decentralized Control of Relief Resources

The preceding sections also have implications with respect to the storage and allocation of materials needed for disaster relief, such as medical supplies, food, water, etc. The issue for planners is to decide whether to store supplies in a central location and have the central command unit allocate them on the basis of its information about the extent of need in various parts of the community, or to store some supplies in numerous local caches and leave to local authorities the responsibility to allocate them as needed. The preceding analysis suggests that the latter is preferable.—/ The central agency is unlikely

---

—/ Obviously this conclusion depends upon the assumption that field personnel will be kept informed of the location and

to be aware of the full extent of need in each part of the community. Furthermore, it takes time to process all the available information before making allocative decisions, and time can mean many lives. Finally, if decentralized groups have resources, they need report to the command center only the extent to which their resources are insufficient. Since most of the community is likely to suffer only moderate damage, this greatly reduces the information flow of the relief system.

One impediment to adopting a more decentralized system of control and use of disaster resources -- an admitted source of the hierarchically structures, procedurally complex decision system the plans establish -- is the financial incentives state and local authorities have put in place for local governments. For example, the Long Beach plan specifically adopts different supply requisitioning procedures for disaster response because of the need to keep records that will make it possible to obtain federal disaster relief assistance.—/ Similarly, much of the

---

—/ City of Long Beach, p. 19 and Appendix 1, p. 7.

---

effort by OES to establish state and regional coordinating activities is a response to the existing structure of control over resources and finances at the state and federal levels.

Approaches to Improving Plans

Most of the shortcomings of existing plans are a natural response to the incentives facing administrative officials. It follows that an improvement in planning can come about only if the incentives change. How can the incentive structure be changed?

One possibility is the provision of financial support for relevant disaster preparedness activities from the appropriate levels of government -- probably the state, since earthquake response will normally involve governments from more than a single county, but rarely from outside the state. The state could pay for, and participate in, the operations of a disaster relief department of, say, county governments. These departments would have the resources necessary to provide planning and training that involves field personnel, and the authority to claim the time of governmental employees in conventional agencies -- fire, public works and police departments, for example -- for disaster preparedness activities. The disaster agency would then assume control of emergency response operations if the ranking local official declared a condition of emergency. It would direct conventional departments in activities related to their traditional function; allocate personnel, equipment and supplies according to plans and existing contingencies; and take principal responsibility for response activities outside of the normal range of responsibilities of existing local agencies, such as mass care

of refugees and search and rescue operations. The organization would, during the disaster, be supergovernmental, able to control resources of all local governments directly affected by the disaster.

The preceding recommendation flies directly in the face of the presumptions in all existing plans. Each local government retains control of its constituents, and each agency is responsible for its own disaster planning. Even the most sophisticated and realistic planning document, the report to the bi-county planning groups, accepts the premise of local control: "Because of the numbers of public and private agencies that operate in the two-county area, it is not feasible to develop a single 'plan' for responding to earthquakes....Although the guide suggests how the system should be organized, it does not suggest how the individual components of the system should organize themselves. Matters of organizing and assigning responsibility are internal problems that are the proper concern of the executives of the various responsible governmental and private agencies..."[1] Perhaps more than any single factor, the political constraints on disaster planning implicit in this statement effectively guarantee a chaotic, ineffective response when a major devastating earthquake strikes.

---

[1] Earthquake Response Planning Guide, p. 1-2.

This harsh conclusion does not apply in the same degree to all organizations: fire departments are well-prepared for the fire-fighting aspects of disaster response. Their preparedness is not due to frequent perusal and practice of a plan. Instead, the department will perform relatively well because it will face demands in the post-earthquake environment that are similar to the demands it faces while carrying out its day-to-day activities. Such is not the case with all relief organizations. If citizens and government officials are serious about earthquake preparedness, they must come to grips with this problem.

In the absence of mandatory planning requirements, overseen and paid for by the state, the spate of planning engendered by the San Fernando quake is likely to subside, for the public attention to earthquake-related problems will tend to abate as San Fernando fades into distant memory. By the time the next earthquake hits, existing plans may be forgotten and response may be no better than in the past. An example of this phenomenon is illustrated in a story about the great fire following the San Francisco earthquake of 1906. During the middle and late nineteenth century, several devastating fires hit San Francisco. In response, the city of San Francisco build numerous cisterns, so that if fire should break our when normal water supplies were disrupted, alternate sources would be available. By the turn of the century, the location of most of the cisterns had been forgotten, so they were of no use in attempts to stop the

conflagrations following the earhquake.[1] A map of their location in the hands of the fire department could have avoided this. More recently, the Packaged Disaster Hospitals provided by the federal government were of limited usefulness during the San Fernando earthquake because their staffs lacked direction, and were not informed of the resources available in the units or even how to assemble them.[2] These experiences should give pause to those who believe that the current experiences in planning will have an important long-term impact on disaster relief.

---

[1] Charles Boden, "San Francisco's Cisterns," California Historical Quarterly, Vol. 15, No. 4 (1937), pp. 1-13.

---

[2] Olson, p. 285
